

What is claimed is:

- 1 1. Cellulose fibers having a median desorption pressure, as determined in
2 a capillary absorption-desorption cycle, of 15 cm or less.
- 1 2. The cellulose fibers of claim 1, wherein the cellulose fibers have a
2 median desorption pressure of 14 cm or less.
- 1 3. The cellulose fibers of claim 1, wherein wherein the cellulose fibers
2 have a median desorption pressure of 13 cm or less.
- 1 4. The cellulose fibers of claim 1, wherein the cellulose fibers have a
2 median desorption pressure of 12 cm or less.
- 1 5. The cellulose fibers of claim 1, wherein the cellulose fibers have a
2 water retention value of 45 percent or less.
- 1 6. The cellulose fibers of claim 5, wherein the cellulose fibers have a
2 water retention value of 38 percent or less.
- 1 7. The cellulose fibers of claim 6, wherein the cellulose fibers have a
2 water retention value of 30 percent or less.
- 1 8. The cellulose fibers of claim 1, wherein the cellulose fibers are
2 crosslinked.
- 1 9. An acquisition and distribution layer comprising the cellulose fibers of
2 claim 1.
- 1 10. An acquisition layer comprising the cellulose fibers of claim 1.
- 1 11. A distribution layer comprising the cellulose fibers of claim 1.

1 12. An absorbent structure comprising:
2 (a) a top layer comprising cellulose fibers having a median
3 desorption pressure, as determined in a capillary absorption-desorption cycle, of 15 cm or
4 less; and
5 (b) a bottom layer comprising SAP particles, the second layer
6 being in fluid communication with the first layer.

1 13. The absorbent structure of claim 12, wherein the cellulose fibers have a
2 median desorption pressure of 14 cm or less.

1 14. The absorbent structure of claim 13, wherein the cellulose fibers have a
2 median desorption pressure of 13 cm or less.

1 15. The absorbent structure of claim 14, wherein the cellulose fibers have a
2 median desorption pressure of 12 cm or less.

1 16. The absorbent structure of claim 12, wherein the cellulose fibers have a
2 water retention value of 45 percent or less.

1 17. The absorbent structure of claim 16, wherein the cellulose fibers have a
2 water retention value of 38 percent or less.

1 18. The absorbent structure of claim 17, wherein the cellulose fibers have a
2 water retention value of 30 percent or less.

1 19. An absorbent structure comprising the cellulose fibers of claim 1.

1 20. An absorbent structure comprising the acquisition and distribution
2 layer of claim 9.

1 21. An absorbent structure comprising the acquisition layer of claim 10.

1 22. An absorbent structure comprising the distribution layer of claim 11.

1 23. A method for preparing cellulose fibers comprising the steps of:

2 (a) refining cellulose fibers to a freeness of from about 300 to
3 about 700 ml CSF; and
4 (b) crosslinking the refined cellulose fibers.

1 24. The method of claim 23, wherein the cellulose fibers to be refined in
2 step (a) are wet lap.

1 25. The method of claim 23, wherein step (a) comprises refining the
2 cellulose fibers to a freeness of from about 500 to about 700 ml CSF.

1 26. The method of claim 25, wherein step (a) comprises refining the
2 cellulose fibers to a freeness of from about 650 to about 700 ml CSF.

1 27. The method of claim 23, wherein step (b) comprises:
2 (i) mixing the refined cellulose fibers with a crosslinking agent;
3 and
4 (ii) curing the cellulose fibers in the mixture.

1 28. The method of claim 23, wherein step (b) comprises:
2 (i) mixing the refined cellulose fibers with a crosslinking agent;
3 (ii) fluffing the cellulose fibers in the mixture; and
4 (iii) curing the cellulose fibers in the mixture.

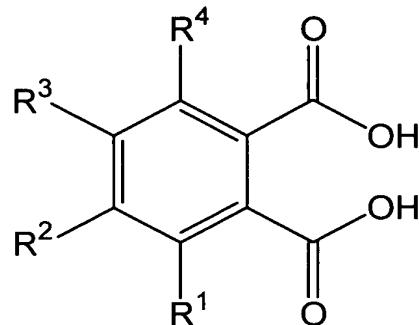
1 29. The method of claim 28, wherein step (b)(iii) comprises drying the
2 cellulose fibers and curing the dried cellulose fibers.

1 30. The method of claim 28, wherein curing is performed at a temperature
2 ranging from about 150 to about 175° C.

- 1 31. Cellulose fibers prepared by the method of claim 23.
- 1 32. A method of preparing an absorbent structure comprising
2 (a) preparing cellulose fibers by the method of claim 23; and
3 (b) incorporating the cellulose fibers into an absorbent structure.
- 1 33. Cellulose fibers crosslinked with at least one crosslinking agent selected
2 from saturated dicarboxylic acids, aromatic dicarboxylic acids, cycloalkyl dicarboxylic acids,
3 bifunctional monocarboxylic acids, and amine carboxylic acids and having a median
4 desorption pressure as measured in a capillary absorption-desorption cycle of 25 cm or less.
- 1 34. The cellulose fibers of claim 33, wherein the saturated dicarboxylic acid
2 has 2 to 8 carbon atoms.
- 1 35. The cellulose fibers of claim 34, wherein the saturated dicarboxylic acid
2 has 2 to 6 carbon atoms.
- 1 36. The cellulose fibers of claim 35, wherein the saturated dicarboxylic acid
2 has 2 to 4 carbon atoms.
- 1 37. The cellulose fibers of claim 34, wherein the saturated dicarboxylic acid is
2 selected from oxalic acid, malonic acid, succinic acid, glutaric acid, adipic acid, pimelic acid,
3 suberic acid, and any combination of any of the foregoing.
- 1 38. The cellulose fibers of claim 33, wherein the saturated dicarboxylic acid is
2 a saturated hydroxy carboxylic acid.
- 1 39. The cellulose fibers of claim 38, wherein the saturated hydroxy carboxylic
2 acid has 2 to 8 carbon atoms.

1 40. The cellulose fibers of claim 39, wherein the hydroxy saturated
2 dicarboxylic acid is selected from glycolic acid, tartaric acid, malic acid, saccharic acid,
3 mucic acid, and any combination of any of the foregoing.

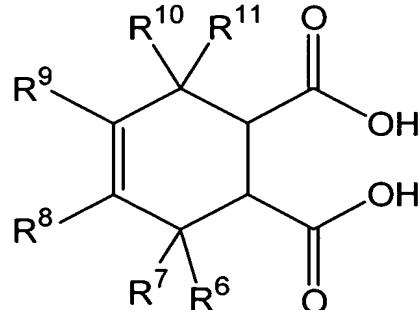
1 41. The cellulose fibers of claim 33, wherein the aromatic dicarboxylic acid
2 has the formula



11 wherein R¹, R², R³, and R⁴ independently are hydrogen, hydroxy, C₁-C₄ alkoxy, C₁-C₄ alkyl,
12 amino, halogen, or nitro.

1 42. The cellulose fibers of claim 41, wherein the aromatic dicarboxylic acid is
2 phthalic acid.

1 43. The cellulose fibers of claim 33, wherein the cycloalkyl dicarboxylic acid
2 has the formula



10 wherein

11 R⁶, R⁷, R¹⁰, and R¹¹ are independently hydrogen, hydroxy, halogen, C₁-C₄ alkoxy, C₁-
12 C₄ alkyl, amino, or nitro; and

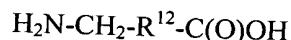
13 R^8 and R^9 are independently hydrogen, halogen, C_1 - C_4 alkoxy, or C_1 - C_4 alkyl.

1 44. The cellulose fibers of claim 43, wherein the cycloalkyl dicarboxylic acid
2 is 1,2,5,6-tetrahydronaphthalic acid.

1 45. The cellulose fibers of claim 33, wherein the bifunctional monocarboxylic
2 acid is selected from salts of a haloacetate, hydroxy monocarboxylic acids, acid derivatives of
3 hydroxy monocarboxylic acids, and any combination of any of the foregoing.

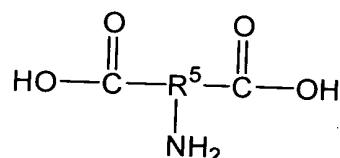
1 46. The cellulose fibers of claim 45, wherein the salt of a haloacetate is
2 sodium chloroacetate.

1 48. The cellulose fibers of claim 47, wherein the amino acid has the formula
2



5 wherein R¹² is a bond, C₁-C₁₂ alkyl, or C₁-C₁₂ alkyl substituted with one or more of carboxyl,
6 hydroxy, C₁-C₄ alkoxy, C₁-C₄ alkyl, amino, and nitro.

1 49. The cellulose fibers of claim 47, wherein the amino acid has the formula



5 where R⁵ is a linear or branched C₁-C₈ alkyl.

1 50. The cellulose fibers of claim 49, wherein R^5 is a C_2 - C_4 alkyl.

1 51. The cellulose fibers of claim 47, wherein the amino acid is selected from
2 aspartic acid, glutamic acid, and any combination of any of the foregoing.

1 52. The cellulose fibers of claim 33, wherein the amine carboxylic acid is
2 ethylenedinitrilotetraacetic acid.

1 53. The cellulose fibers of claim 33, wherein the cellulose fibers have been
2 crosslinked with from about 5 to about 21 mole percent of crosslinking agent, calculated on a
3 cellulose anhydroglucose molar basis.

1 54. The cellulose fibers of claim 33, wherein the cellulose fibers have been
2 crosslinked in the presence of a crosslinking facilitator.

1 55. The cellulose fibers of claim 54, wherein the crosslinking facilitator and
2 the crosslinking agent are different.

1 56. The cellulose fibers of claim 54, wherein the crosslinking facilitator is
2 oxalic acid.

1 57. The cellulose fibers of claim 54, wherein the cellulose fibers have been
2 crosslinked in the presence of from about 1.8 to about 9 mole percent of crosslinking
3 facilitator, calculated on a cellulose anhydroglucose molar basis.

1 58. The cellulose fibers of claim 54, wherein the cellulose fibers have been
2 crosslinked with from about 0.5 to about 40 mole percent of crosslinking agent and
3 crosslinking facilitator, calculated on a cellulose anhydroglucose molar basis.

1 59. The cellulose fibers of claim 58, wherein the cellulose fibers have been
2 crosslinked with from about 1 to about 30 mole percent of crosslinking agent and
3 crosslinking facilitator, calculated on a cellulose anhydroglucose molar basis.

1 60. The cellulose fibers of claim 33, wherein the cellulose fibers are derived
2 from wood pulp.

1 61. The cellulose fibers of claim 33, wherein the cellulose fibers have been
2 refined prior to crosslinking.

1 62. The cellulose fibers of claim 61, wherein the cellulose fibers have been
2 refined to a freeness of from about 300 to about 700 ml CSF prior to crosslinking.

1 63. The cellulose fibers of claim 62, wherein the cellulose fibers have been
2 refined to a freeness of from about 500 to about 700 ml CSF prior to crosslinking.

1 64. The cellulose fibers of claim 63, wherein the cellulose fibers have been
2 refined to a freeness of from about 650 to about 700 ml CSF prior to crosslinking.

1 65. The cellulose fibers of claim 33, wherein the cellulose fibers have been
2 cured at a temperature of from about 105 to about 225° C.

1 66. The cellulose fibers of claim 65, wherein the cellulose fibers have been
2 cured at a temperature of from about 150 to about 190° C.

1 67. The cellulose fibers of claim 66, wherein the cellulose fibers have been
2 cured at a temperature of from about 160 to about 175° C.

1 68. The cellulose fibers of claim 33, wherein the cellulose fibers have been
2 cured in the presence of a reducing agent.

1 69. The cellulose fibers of claim 68, wherein the reducing agent is a
2 hypophosphite.

1 70. The cellulose fibers of claim 69, wherein the reducing agent is sodium
2 hypophosphite.

1 71. The cellulose fibers of claim 33, wherein the water retention value of the
2 cellulose fibers is 50 percent or less.

1 72. The cellulose fibers of claim 71, wherein the water retention value of the
2 cellulose fibers is 45 percent or less.

1 73. The cellulose fibers of claim 72, wherein the water retention value of the
2 cellulose fibers is 38 percent or less.

1 74. The cellulose fibers of claim 73, wherein the water retention value of the
2 cellulose fibers is 30 percent or less.

1 75. The cellulose fibers of claim 33, wherein the median desorption pressure
2 of the cellulose fibers as measured in a capillary absorption-desorption cycle is 20 cm or less.

1 76. The cellulose fibers of claim 75, wherein the median desorption pressure
2 of the cellulose fibers as measured in a capillary absorption-desorption cycle is 18 cm or less.

1 77. The cellulose fibers of claim 76, wherein the median desorption pressure
2 of the cellulose fibers as measured in a capillary absorption-desorption cycle is 15 cm or less.

1 78. The cellulose fibers of claim 33, wherein the crosslinking is substantially
2 reversible.

1 79. The cellulose fibers of claim 33, wherein the crosslinking agent is oxalic
2 acid and the crosslinking is substantially reversible.

1 80. Uncrosslinked cellulose fibers prepared by uncrosslinking the cellulose
2 fibers of claim 33.

- 1 81. The uncrosslinked cellulose fibers of claim 80, wherein the crosslinking
- 2 agent contains 4 carbon atoms or less.
- 1 82. The uncrosslinked cellulose fibers of claim 81, wherein the crosslinking
- 2 agent is oxalic acid.
- 1 83. The uncrosslinked cellulose fibers of claim 81, wherein the crosslinking
- 2 agent is sodium chloroacetate.
- 1 84. The uncrosslinked cellulose fibers of claim 80, wherein the uncrosslinking
- 2 step comprises soaking the cellulose fibers in water.
- 1 85. The uncrosslinked cellulose fibers of claim 84, wherein the uncrosslinking
- 2 step comprises soaking the cellulose fibers in water for from about 0.5 to about 4 hours.
- 1 86. A sheet comprising the uncrosslinked cellulose fibers of claim 80.
- 1 87. An absorbent structure comprising the fibers of claim 33.
- 1 88. A method of preparing crosslinked cellulose fibers comprising intrafiber
- 2 crosslinking the cellulose fibers with at least one saturated dicarboxylic acid, aromatic
- 3 dicarboxylic acid, cycloalkyl dicarboxylic acid, bifunctional monocarboxylic acid, or amine
- 4 carboxylic acid.
- 1 89. The method of claim 88, wherein the saturated dicarboxylic acid has 2 to
- 2 8 carbon atoms.
- 1 90. The method of claim 89, wherein the saturated dicarboxylic acid has 2 to
- 2 6 atoms.
- 1 91. The method of claim 90, wherein the saturated dicarboxylic acid has 2 to
- 2 4 carbon atoms.

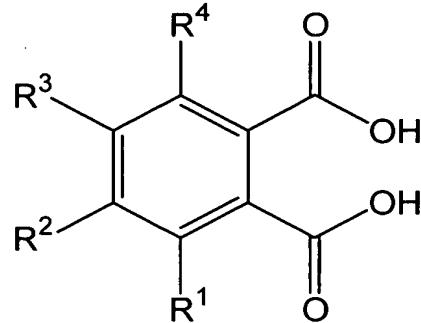
1 92. The method of claim 89, wherein the saturated dicarboxylic acid is
2 selected from oxalic acid, malonic acid, succinic acid, glutaric acid, adipic acid, pimelic acid,
3 suberic acid, and any combination of any of the foregoing.

1 93. The method of claim 88, wherein the saturated dicarboxylic acid is a
2 saturated hydroxy carboxylic acid.

1 94. The method of claim 93, wherein the saturated hydroxy carboxylic acid
2 has 2 to 8 carbon atoms.

1 95. The method of claim 94, wherein the C₂-C₈ hydroxy saturated
2 dicarboxylic acid is selected from glycolic acid, tartaric acid, malic acid, saccharic acid,
3 mucic acid, and any combination of any of the foregoing.

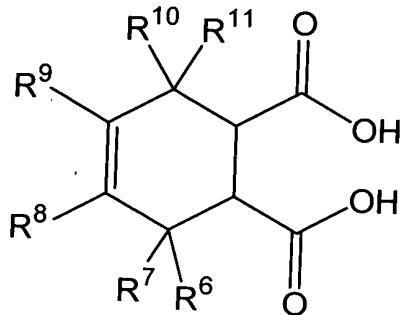
1 96. The method of claim 88, wherein the aromatic dicarboxylic acid has the
2 formula



1 10 wherein R¹, R², R³, and R⁴ independently are hydrogen, hydroxy, C₁-C₄ alkoxy, C₁-C₄ alkyl,
11 amino, halogen, or nitro.

1 97. The method of claim 96, wherein the aromatic dicarboxylic acid is
2 phthalic acid.

1 98. The method of claim 88, wherein the cycloalkyl dicarboxylic acid has the
2 formula



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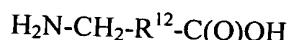
1 99. The method of claim 98, wherein the cycloalkyl dicarboxylic acid is
 2 1,2,5,6-tetrahydrophtalic acid.

1 100. The method of claim 88, wherein the bifunctional monocarboxylic acid
 2 is selected from salts of a haloacetate, hydroxy monocarboxylic acids, acid derivatives of
 3 hydroxy monocarboxylic acids, and any combination of any of the foregoing.

1 101. The method of claim 100, wherein the salt of a haloacetate is sodium
 2 chloroacetate.

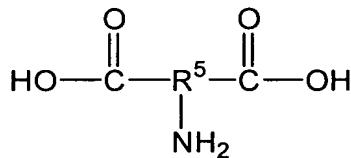
1 102. The method of claim 88, wherein the amine carboxylic acid is an amino
 2 acid.

1 103. The method of claim 102, wherein the amino acid has the formula
 2



5 wherein R^{12} is a bond, C_1 - C_{12} alkyl, or C_1 - C_{12} alkyl substituted with one or more of carboxyl,
 6 hydroxy, C_1 - C_4 alkoxy, C_1 - C_4 alkyl, amino, and nitro.

1 104. The method of claim 102, wherein the amino acid has the formula



5 where R^5 is a linear or branched C₁-C₈ alkyl.

1 105. The method of claim 104, wherein R^5 is a C₂-C₄ alkyl.

1 106. The method of claim 102, wherein the amino acid is selected from
2 aspartic acid, glutamic acid, and any combination of any of the foregoing.

1 107. The method of claim 88, wherein the amine carboxylic acid is
2 ethylenedinitrilotetraacetic acid.

1 108. The method of claim 88, wherein the mole percent of crosslinking agent
2 ranges from about 5 to about 21 mole percent, calculated on a cellulose anhydroglucose
3 molar basis.

1 109. The method of claim 88, wherein the crosslinking step is performed in
2 the presence of a crosslinking facilitator.

1 110. The method of claim 109, wherein the crosslinking agent is different
2 than the crosslinking facilitator.

1 111. The method of claim 109, wherein the crosslinking facilitator is oxalic
2 acid.

1 112. The method of claim 109, wherein the mole percent of crosslinking
2 facilitator ranges from about 1.8 to about 9 mole percent, calculated on a cellulose
3 anhydroglucose molar basis.

1 113. The method of claim 109, wherein the mole percent of crosslinking
2 agent and crosslinking facilitator ranges from about 0.05 to about 40, calculated on a
3 cellulose anhydroglucose molar basis.

1 114. The method of claim 113, wherein the mole percent of crosslinking
2 agent and crosslinking facilitator ranges from about 1 to about 30, calculated on a cellulose
3 anhydroglucose molar basis.

1 115. The method of claim 88, wherein the crosslinking step comprises:
2 (i) mixing the cellulose fibers with the crosslinking agent; and
3 (ii) curing the cellulose fibers in the mixture.

1 116. The method of claim 115, wherein the crosslinking step comprises:
2 (i) mixing the cellulose fibers with the crosslinking agent;
3 (ii) fluffing the cellulose fibers in the mixture; and
4 (iii) curing the cellulose fibers in the mixture.

1 117. The method of claim 116, wherein step (iii) comprises drying the
2 cellulose fibers and curing the dried cellulose fibers.

1 118. The method of claim 115, wherein curing is performed at a temperature
2 ranging from about 150 to about 175° C.

1 119. The cellulose fibers of claim 88, wherein the fibers are crosslinked in the
2 presence of a reducing agent.

1 120. The cellulose fibers of claim 119, wherein the reducing agent is a
2 hypophosphite.

1 121. The cellulose fibers of claim 120, wherein the reducing agent is sodium
2 hypophosphite.

1 122. The method of claim 88, wherein the cellulose fibers are refined prior to
2 the crosslinking step.

1 123. The method of claim 122, wherein the cellulose fibers are refined to a
2 freeness of from about 500 to about 700 ml CSF.

1 124. The method of claim 123, wherein the cellulose fibers are refined to a
2 freeness of from about 650 to about 700 ml CSF.

1 125. Cellulose fibers prepared by the method of claim 88.

1 126. A method of preparing uncrosslinked fibers comprising the steps of
2 intrafiber crosslinking cellulose fibers with at least one saturated dicarboxylic acid, aromatic
3 dicarboxylic acid, cycloalkyl dicarboxylic acid, bifunctional monocarboxylic acid, or amine
4 carboxylic acid; and uncrosslinking the crosslinked cellulose fibers.

1 127. The method of claim 126, wherein the crosslinking agent contains 4
2 carbon atoms or less.

1 128. The method of claim 127, wherein the crosslinking agent is oxalic acid.

1 129. The method of claim 127, wherein the crosslinking agent is sodium
2 chloroacetate.

1 130. The method of claim 126, wherein the uncrosslinking step comprises
2 soaking the crosslinked cellulose fibers in water.

1 131. The method of claim 130, wherein the uncrosslinking step comprises
2 soaking the crosslinked cellulose fibers in water for from about 0.5 to about 4 hours.

1 132. A method of preparing a sheet of uncrosslinked cellulose fibers
2 comprising the steps of preparing uncrosslinked cellulose fibers by the method of claim 126
3 and forming the uncrosslinked cellulose fibers into a sheet.

1 133. A method of preparing crosslinked cellulose fibers comprising the steps
2 of:
3 (a) preparing uncrosslinked cellulose fibers by the method of claim
4 126; and
5 (b) crosslinking the cellulose fibers.

1 134. A method of preparing an absorbent structure comprising
2 (a) preparing cellulose fibers by the method of claim 88; and
3 (b) incorporating the cellulose fibers into an absorbent structure.

1 135. An absorbent core comprising superabsorbent polymer particles and
2 reversible crosslinked cellulose fibers.

1 136. The absorbent core of claim 135, wherein the reversible crosslinked
2 cellulose fibers are crosslinked with oxalic acid, sodium chloroacetate, or a mixture thereof.

1 137. The absorbent core of claim 136, wherein the reversible crosslinked
2 cellulose fibers are crosslinked with oxalic acid.

1 138. The absorbent core of claim 135, wherein the absorbent core comprises
2 from about 30 to about 70% by weight of superabsorbent particles and from about 70 to about
3 30% by weight of reversible crosslinked fibers, based on 100% total weight of the absorbent
4 core.